King Abdulaziz University
Faculty of Sciences
Physics Department

Final Exam - Phys 110

First Term
1432-1433 H

Date: 9/ 2/ 1433H

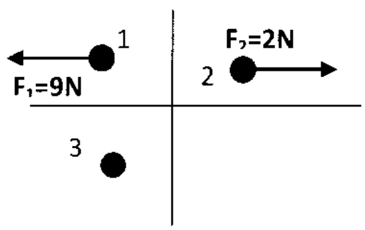
A

Name: **ID No:** **Section:**

1. A 0.4 kg ball is dropped from a window and landed on the street with speed 35 m/s, and then rebound with a speed 25 m/s. **The magnitude of the change of its momentum is:**

   a) 40 kg m/s b) 10 kg m/s c) 20 kg m/s d) 24 kg m/s

2. In the figure, **what is the magnitude of the force F_3** acting on particle 3 if the center of mass of the system is **stationary**?

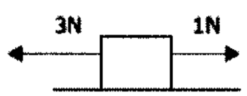


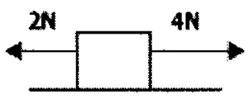
   a) 2 N b) - 9 N c) 7 N d) 10 N

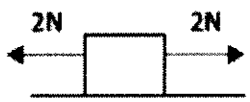
3. The **kinetic energy of a 2g** particle traveling at 500 m/s is:

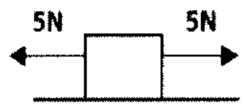
   a) 0.5 J b) 500 J c) 250 J d) 2500 J

4. A box slides to the right over a frictionless table, in **which figure the net force does a negative work?**

a) 

b) 

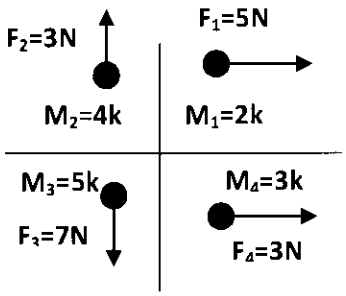
c) 

d) 

5. In which situation of the following **the work** done by the force is **positive** ?

a) The angle between F and d is 76^0
b) The angle between F and d is 100^0
c) $\vec{F} = 7\hat{i} + 9\hat{j}$ and $\vec{d} = -2\hat{i}$
d) $\vec{F} = 5\hat{i} - 10\hat{j}$ and $\vec{d} = 2\hat{j}$

6. In the figure, four objects are subjected to external forces. **The x and y components** of acceleration of the center of mass **a_x and a_y are:**

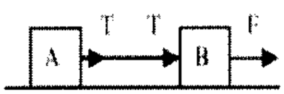


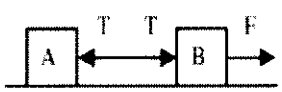
a) $a_{com,x}$= 0.14 m/s², $a_{com,y}$= 0.17 m/s²
b) $a_{com,x}$= 0.57 m/s², $a_{com,y}$= - 0.29 m/s²
c) $a_{com,x}$= 0.71 m/s², $a_{com,y}$= 0.24 m/s²
d) $a_{com,x}$= 0.19 m/s², $a_{com,y}$= - 0.51 m/s²

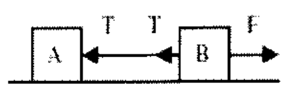
7. Which quantity of the following is **a scalar quantity** ?

a) acceleration b) force c) work d) linear momentum

8. Which figure of the following give **the correct direction of the tension T** ?

a)


b)


c)


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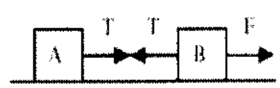


9. A particle moves along an x axis, if the velocity of the particle changes from -3 m/s to 2 m/s, the **kinetic energy** of the particle

a) increase b) decrease c) remain constant d) zero

10. A body of mass of 10 kg and speed of 5 m/s, suddenly split into three bodies. **The momentum** of the body **before the split** is:

a) 50 kg m/s b) 25 kg m/s c) 15 kg m/s d) 10 kg m/s

11. **What is the y-coordinate** of the 4 kg particle in the table below, if the center of mass of the three particle system has the coordinates (- 0.33m , 1.33m)

Mass	x-coordinate	y-coordinate
2 kg	3 m	2 m
3 kg	1 m	- 4 m
4 kg	-3 m	

a) 2 m b) - 3 m (c) 5 m d) - 4 m

12. Two particles of masses 2 kg and 3 kg are located at 1 m and 2 m from the origin along the x axis respectively. **The position of the center of mass** is:

(a) 1.6 m b) 0 c) 1 m d) 2.7 m

13. **What velocity** a 5000 kg truck must have in order to have **the same momentum** of a 10000 kg truck whose velocity is 20 m/s ?

a) 20 m/s (b) 40 m/s c) 60 m/s d) 80 m/s

Use the following to answer questions 14-15:

If the kinetic energy of a particle of **mass 2 kg** is **initially 10 J** and there is a net energy transfer of **5 J to the particle**

14. **The final kinetic energy** of the particle is:

a) 25 J (b) 15 J c) 30 J d) zero

15. **The initial speed** of the particle is:

(a) 3.16 m/s b) 15 m/s c) 2.24 m/s d) 5 m/s

16. A force of 100 N acts on a box moving with a constant speed of 5 m/s along the positive x axis. **The power due to this force is :**

a) 5 W b) 50 W c) 250 W (d) 500 W

17. A 6 kg body moves with a constant acceleration starting from rest to a speed of 15 m/s. **The work done** on the body is:

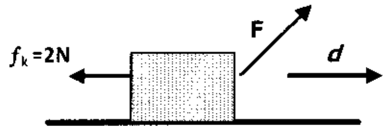
(a) 675 J b) 350 J c) 450 J d) 100 J

18. A force acts on a spring of length 30 cm and compressed it to a length of 25 cm, if the spring constant is 50 N/m. **The work done by the spring is:**

a) 11.38 J b) 3750 J c) 678 J (d) 0.69 J

Use the following to answer questions 19-21:

A force $\vec{F} = 5\hat{i} + 10\hat{j}$ is applied to a block that moves a distance $\vec{d} = 2\hat{i}$ on a surface as shown.



19. **The work done** on the block **by the normal force F_N is:**

a) F_N d cos 0^0 (b) F_N d cos 90^0 c) F_N d d) F_N d cos 180^0

20. **The work done** on the block **by the frictional force f_k is:**

a) - 3 J b) 2 J c) 1 J (d) - 4 J

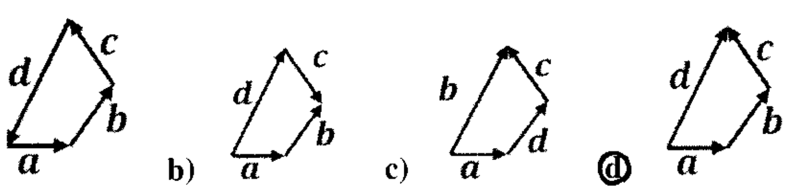
21. **The work done** on the block **by the force F** is:

a) 35 J b) 30 J c) 25 J (d) 10 J

22. **The magnitude of the centripetal force is:**

a) $F = m\frac{v^2}{R^2}$ (b) $F = m\frac{v^2}{R}$ c) $F = m\frac{v}{R}$ d) $F = \frac{v^2}{R}$

23. The vectors $\vec{a}, \vec{b}, \vec{c},$ *and* $\vec{d}$ are related by $\vec{a} + \vec{b} + \vec{c} = \vec{d}$. **Which diagram** below illustrates this relationship?



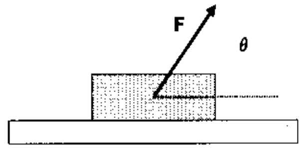
a) b) c) (d)

24. A particle travels in a circle of radius R with constant speed v. **The period of 3 revolutions is:**

a) $\frac{7\pi R}{v}$ b) $\frac{5\pi R}{v}$ (c) $\frac{6\pi R}{v}$ d) $\frac{2\pi R}{v}$

Use the following to answer questions 25-26:

In the figure a force F is applied to a block of mass m that slides along a floor, the coefficient of kinetic friction between the block and the floor is μ_K .



25. The x-component of the net force is:

a) $F\cos\theta - \mu_K F_N = 0$

b) $F\cos\theta - \mu_K F_N = ma_x$

c) $F\sin\theta - \mu_K = ma_x$

d) $F\sin\theta - mg = ma_x$

26. The y-component of the net force is:

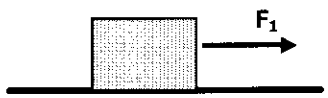
a) $F_N - mg = 0$

b) $F\sin\theta - mg = 0$

c) $F_N + F\cos\theta - mg = 0$

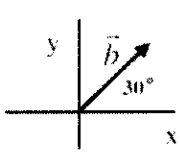
d) $F_N + F\sin\theta - mg = 0$

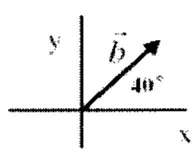
27. There are two horizontal forces acting on the 2 kg box but only one force F_1 = 20 N is shown in the figure, the box moves along the x axis with acceleration a = 20 m/s². **The second force F_2 =**

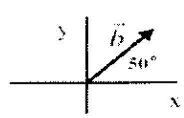


a) 20 N b) 10 N c) 30 N d) 50 N

28. In which figure of the following **b_x = 8.7 m** ? (b = 10 m)

a) 

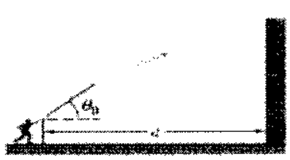
b) 

c) 

d) 

Use the following to answer questions 29-30:

You throw a ball toward a wall at speed 20 m/s and at angle $\theta_0 = 33^0$ above horizontal. It takes 0.8 s to hit the wall.



29. The vertical component of its velocity as it hits the wall is:

a) 0.31 m/s b) 31 m/s c) zero (d) 3.1 m/s

30. The horizontal component of its velocity as it hits the wall is:

a) zero b) 11 m/s (c) 16.8 m/s d) 30 m/s

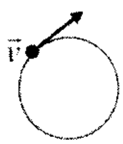
31. The components of $\vec{a}$ are: $a_x = 3$ m, and $a_y = 4$ m , the **direction** of $\vec{a}$ is:

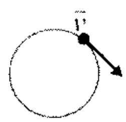
(a) 53.13° b) 59° c) 63.4° d) 66.8°

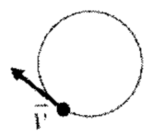
32. If $\vec{D} = 5\hat{i} + 25\hat{j}$, then $\frac{2\vec{D}}{10}$ **equals:**

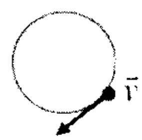
a) $\hat{i} - 5\hat{j}$ b) $5\hat{i} - \hat{j}$ (c) $\hat{i} + 5\hat{j}$ d) $5\hat{i} + \hat{j}$

33. In circular motion, which figure represents the velocity $\vec{v} = 400\hat{i} + 500\hat{j}$

(a) 

b) 

c) 

d) 

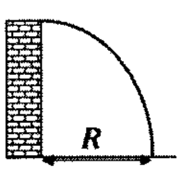
34. A particle undergoes a displacement $\Delta\vec{r} = 2\hat{i} - 3\hat{j} + 6\hat{k}$ **, The average velocity** of the particle **in 2 s is:**

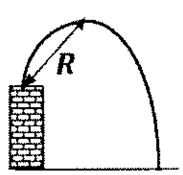
(a) $\hat{i} - 1.5\hat{j} + 3\hat{k}$ b) $\hat{i} - 3\hat{j} + 3\hat{k}$ c) $2\hat{i} - 3\hat{j} + 6\hat{k}$ d) $2\hat{i} - 3\hat{j} + 3\hat{k}$

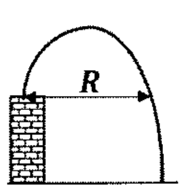
35. The range of a ball thrown at angle 30° above horizontal with velocity V_0 is

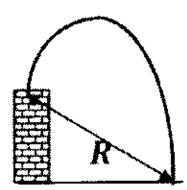
a) $\frac{V_0^2}{g}$ (b) $\frac{V_0^2}{g}\sin 60$ c) $\frac{V_0^2}{g}\sin 30$ d) $\frac{V_0^2}{g}\sin 120$

36. In which figure **R represents the range** of the projectile ?

a) 

b) 

(c) 

d) 

37. **One Watt equals:**

a) J/s b) J/s^2 c) $J.s^2$ d) J.s

38. The magnitude of $\vec{A}\times\vec{B}=0$ **if the angle** between $\vec{A}$ and $\vec{B}$ is:

a) 45^0 b) 90^0 c) 270^0 d) 0^0

39. **The magnitude of** the vector $\vec{A}=5\hat{k}$ is:

a) 0 b) 5 c) 10 d) 50

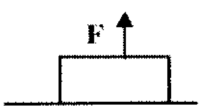
40. **The base quantities** of the SI units (m, kg, s) respectively are:

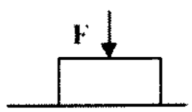
a) (force, mass, time)
b) (length, mass, time)
c) (mass, speed, time)
d) (length, weight, time)

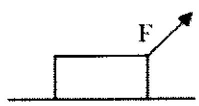
41. The position of a particle is given by: $x(t)= 10 + t^2$,the **instantaneous acceleration at t= 1 s** is:

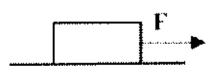
a) 8 m/s^2 b) 6 m/s^2 c) 2 m/s^2 d) 4 m/s^2

42. **In which figure** of the following the normal force on the block of mass m equals F_N **= mg**

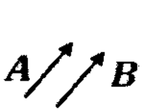
a) 

b) 

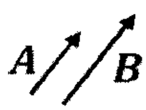
c) 

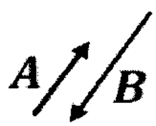
d) 

43. Which figure shows $\vec{A}=-\vec{B}$

a) 

b) 

c) 

d) 

44. A particle undergoes a displacement $\Delta\vec{r}=2\hat{i}-3\hat{j}+6\hat{k}$ **, If** $\vec{r}_2=3\hat{j}-4\hat{k}$ **then:**

a) $\vec{r}_1=2\hat{i}-9\hat{j}+10\hat{k}$ b) $\vec{r}_1=2\hat{i}+2\hat{k}$ c) $\vec{r}_1=2\hat{i}+10\hat{k}$ d) $\vec{r}_1=-2\hat{i}+6\hat{j}-10\hat{k}$

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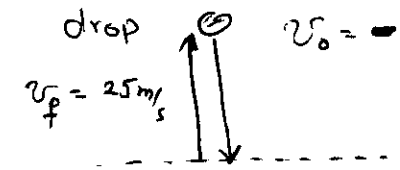
Q(1):

rebound = ارتدت

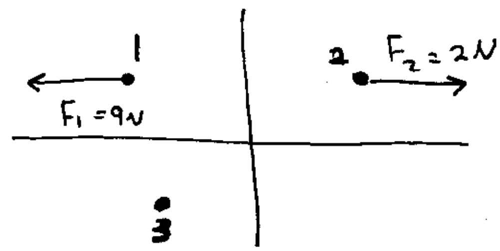


$v_0 = -35\ m/s$

$$|\Delta P| = |P_f - P_i| = m|v_f - v_i|$$

$$= 0.4\,|25 - (-35)| = 0.4\,|60| = 24\ kg \cdot m/s \quad (d)$$

Q(2) CoM is stationary



$$\sum F_x = 0$$

$$F_{1x} + F_{2x} + F_{3x} = 0$$

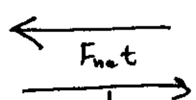
$$-9 + 2 + F_{3x} = 0 \Rightarrow F_{3x} = +7N \quad (c)$$

Q(3) $m = 2g = 2 \times 10^{-3}\ kg$ $v = 500\ m/s$ $\Rightarrow K.E = ??$

$$K.E = \frac{1}{2} m v^2 = \frac{1}{2}(2 \times 10^{-3})(500)^2 = 250J \quad (c)$$

Q(4) (a)

$F_{net} = \sum F_x = 1 - 3 = -2N$



F ↑↓ d (anti-parallel) ✓

$\Theta = 180 \Rightarrow W(-ve)$

(c)

$F_{net} = 2 - 2 = 0$

$W = 0$

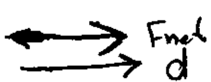
(d)

$F_{net} = 5 - 5 = 0$

$W = 0$

b (b)

$F_{net} = 4 - 2 = +2N$



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$W \Rightarrow +ve$ $\quad 0 \le \theta < 90$ or. $F \nearrow\nearrow d$ (Parallel

Q(5) a) $\theta = 76° < 90$ ← ⓐ

$\Rightarrow W(+ve)$

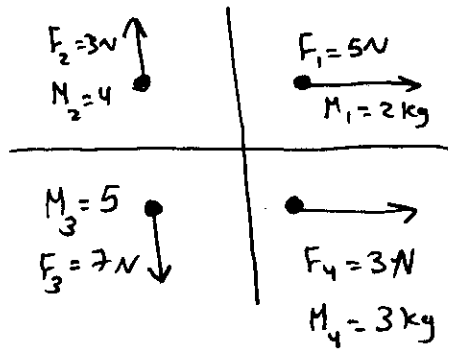
b) $\theta = 100 > 90 \Rightarrow W(-ve)$

c) $W = F \cdot d = 7 \times -2 + 0 = -14\,J \Rightarrow -ve$

d) $W = 0 - 10 \times 2 = -20\,J \Rightarrow -ve$

Q(6)

particle	mass	F_x	F_y
1	2	+5	0
2	4	0	+3
3	5	0	-7
4	3	+3	0
	M = 14		



$\Sigma F_x = M\, a_{com,x}$ $\qquad \Sigma F_y = M\, a_{com}$

$a_{com,x} = \frac{\Sigma F_x}{M} = \frac{F_{1x} + F_{2x} + F_{3x} + F_{4x}}{M}$

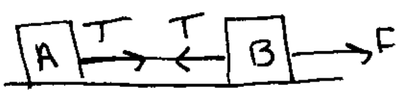
$= \frac{5+0+0+3}{14} = 0.57\ m/s$

$a_{com,y} = \frac{\Sigma F_y}{M} = \frac{F_{1y} + F_{2y} + F_{3y} + F_{4y}}{M}$

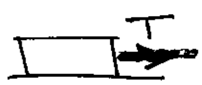
$= \frac{0+3-7+0}{14} = -0.29\ m/s^2$

ⓑ

Q(8) ⓓ



اتجاه شد الحبل (T) يخرج من الجسم في اتجاه الحبل



Q(9) $v_i = -3\ m/s$ $\qquad v_f = 2\ m/s$

$K_i = \frac{1}{2} m (-3)^2$ $\qquad K_f = \frac{1}{2} m (2)^2$

$= \frac{1}{2} m (9)$ $\qquad = \frac{1}{2} m (4)$

or $\Delta K = K_f - K_i = \frac{1}{2} m (v_f^2 - v_i^2)$

$= \frac{1}{2} m (4 - 9) = -\frac{5}{2} m$

$-ve$ ✓ decrease

v : -3 to 2

$\Rightarrow v$ decrease

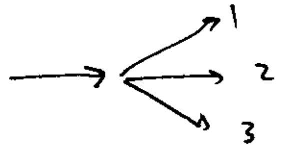
$\Rightarrow$ K. E decrease

ⓑ

هنــــاء فرحاز

Q(10)

① $m = 10\,kg$ $v = +5\,m/s$



P initial P final

$P_p = mv = 10 \times 5 = 50\ Kg \cdot m/s$ ⓐ

Q(11) $(-0.33m,\ 1.33m)$

↓ x_{com} ↓ y_{com}

Mass	X	y
2	3	2
3	1	-4
4	-3	$y_3 = ??$
$M = 9$	$x_{com} = -0.33$	$y_{com} = 1.33$

$y_{com} = \frac{m_1 y_1 + m_2 y_2 + m_3 y_3}{M}$

$1.33 = \frac{2 \times 2 + 3 \times -4 + 4 \times y_3}{9}$

$9 \times 1.33 = 4 - 12 + 4 y_3$

$4 y_3 = 11.97 - 4 + 12 = 19.97$

$y_3 = \frac{19.97}{4} = 4.99 = 5\,m$ ⓒ

Q(12)

P.	M	X
1	2	1
2	3	2
	$M = 5$	

$\Rightarrow$ Position $= x_{com} = \frac{2 \times 1 + 3 \times 2}{5} = \frac{2 + 6}{5}$.

$x_{com} = 1.6\ m$ ⓐ

Q(13)

$m_1 = 5000\ kg$ $v_1 = ??$

$m_2 = 10000\,kg$ $v_2 = 20\ m/s$

$P_1 = P_2$

$m_1 v_1 = m_2 v_2 \Rightarrow v = \frac{m_2 v_2}{m_1} = \frac{10000 \times 20}{5000} = 40\,m/s$ ⓑ

Q(14) $m = 2\,kg$ $K_i = 10\,J$ $W_{net} = \Delta K = +5\,J$ (↓ to)

Q(14) $\Delta K = K_f - K_i$

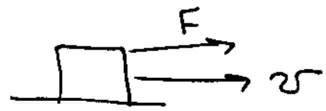
$5 = K_f - 10 \Rightarrow K_f = 5 + 10 = 15\ J$ ⓑ

هنـــاء فرحان

Q(15) $K = \frac{1}{2} m v^2 \Rightarrow K_i = \frac{1}{2} m v_i^2$ (a)

$10 = \frac{1}{2}(2) v_i^2 \Rightarrow v_i = \sqrt{10} = 3.16 \ m/s$

Q(16) $F = 100 N$ $v = 5 \ m/s$



$P = F \cdot v = F v \cos\theta$

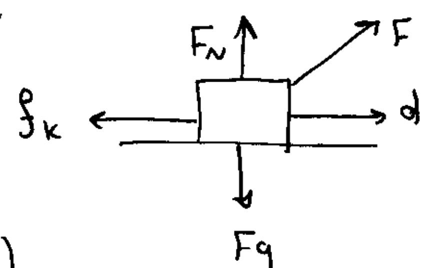
$= (100)(5)\cos(0) = 500 \ Watt$ (d)

Q(17) $m = 6 \ kg$ a: const. $v_i = 0$ $v_f = 15 \ m/s$

$W = \Delta K = \frac{1}{2} m [v_f^2 - v_i^2]$

$= \frac{1}{2}(6)[15^2 - 0] = 675 J$ (a)

Q(18) $\vec{F} = 5\hat{i} + 10\hat{j}$ $d = 2\hat{i}$



Q(19) $W_{F_N} = F_N d \cos 90 = 0$ (b)

Q(20) $W_f = -fd = -(2)(2) = -4 J$ (d)

Q(21) $W_F = F \cdot d = 5 \times 2 + 10 \times 0 = 10 J$ (d)

Q(18) $x_i = 30 \ cm = 30 \times 10^{-2} m$ $x_f = 25 \ cm = 25 \times 10^{-2} m$ $k = 50 \ N/m$

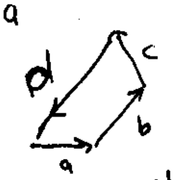
$W_s = \frac{1}{2} k (x_i^2 - x_f^2) = \frac{1}{2}(50)[(30 \times 10^{-2})^2 - (25 \times 10^{-2})^2] = 0.69 J$ (d)

Q(22) $|F_\perp| = m a_\perp = m \frac{v^2}{r}$ (b)

هنـــاء فرحان $\vec{a}+\vec{b}+\vec{c}=\vec{d}$

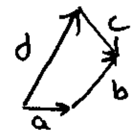
Q(23)

a



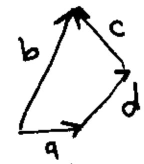
$a+b+c=-d$

(b)



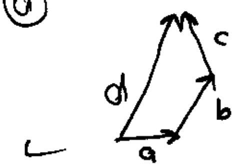
$a+b-c=d$

(c)



$a+d+c=b$

(d)



$a+b+c=d$

(d)

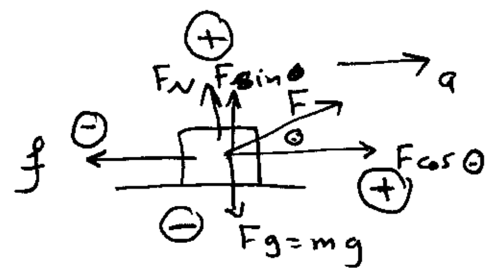
Q(24) 3 revolution $= 3T$

$T = \frac{\text{distance}}{\text{speed}} = \frac{2\pi r}{v}$ ([illegible])

$T = \frac{2\pi R}{v}$

$t = 3T = 3\left(\frac{2\pi R}{v}\right) = 6\frac{\pi R}{v}$ (c)

Q(25)



$\Sigma F_x = ma_x$

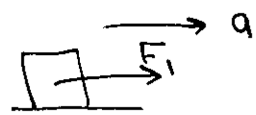
$\Sigma F_x = F\cos\theta - f_k = ma$

$F\cos\theta - \mu_k F_N = ma$ (b)

Q(26) $\Sigma F_y = 0$

$F_N + F\sin\theta - mg = 0$ (d)

Q(27) $a = +20$ m/s



$\Sigma F_x = ma_x$

$F_{1x} + F_{2x} = +ma$

$F_{2x} = ma - F_{1x} = (2)(20) - (+20) = 20N$ (a)

Q(28) $b_x = b\cos\theta$

a) $b_x = 10\cos 30 = 8.7$ m

b) $b_x = 10\cos 40 = 7.7$ m

c) $b_x = 10\cos 50 = 6.4$ m

d) $b_x = 10\cos 60 = 5$ m

(a)

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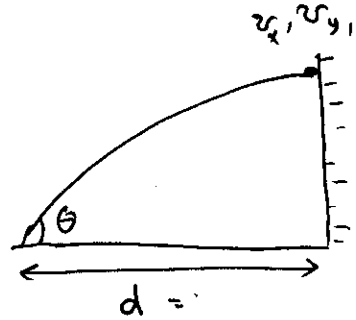


$v_0 = 20\ m/s \qquad \theta_0 = 33^\circ \qquad t = 0.8s$

Q(29) $v_y = v_{oy} - gt$

$= v_0 \sin\theta_0 - gt$

$= 20\sin(33) - 9.8(0.8) = 3.1\ m/s$ (d)

Q(30) $v_x = v_{ox} = v_0 \cos\theta$

$= 20 \cos(33) = 16.8\ m/s$ (c)

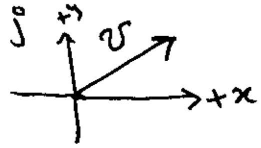
Q(31) $\theta = \tan^{-1}\frac{a_y}{a_x} = \tan^{-1}\frac{4}{3} = 53.13^\circ$ (a)

Q(32) $\vec{D} = 5\hat{i} + 25\hat{j}$

$\frac{2}{10} = \frac{1}{5}$

$\frac{2\vec{D}}{10} = \frac{2}{10}(5)\hat{i} + \frac{2}{10}(25)\hat{j} = \hat{i} + 5\hat{j}$ (c)

Q(33) $v = 400\hat{i} + 500\hat{j}$
(+) (+)



(a)

v متجهة في الربع الأول لأن $v_x \to (+)$, $v_y \to +$

Q(34) $\Delta r = 2\hat{i} - 3\hat{j} + 6k \qquad \Delta t = 2s$

$v_{avg} = \frac{\Delta r}{\Delta t} = \frac{2}{2}\hat{i} - \frac{3}{2}\hat{j} + \frac{6}{2}k = \hat{i} - 1.5\hat{j} + 3k$ (a)

Q(35) $R = \frac{v_i^2}{g}\sin 2\theta_0 \qquad \theta_0 = 30 \qquad 2\theta_0 = 2\times 30 = 60$

$R = \frac{v_0^2}{g}\sin 60$

Q(36)

(c)

R هي المسافة بين بداية الانطلاق والعودة
الى نفس المستوى

هناء فرحان

$P = \frac{W}{s}$

Q (37) $1\ \text{Watt} = \frac{J}{s}$ (a)

Q (38) $A \times B = AB \sin\phi$

$A \times B = 0 \Rightarrow \sin\phi = 0 \Rightarrow \phi = 0$ (d)

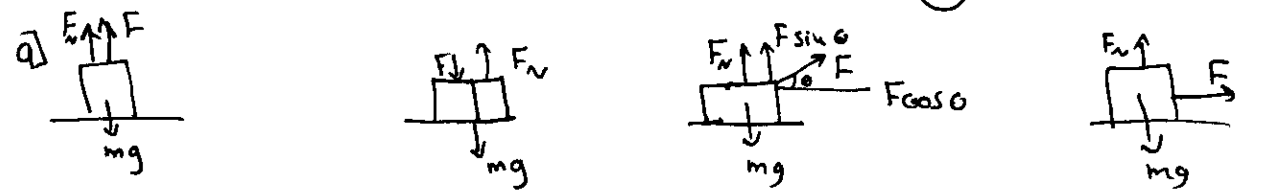
Q (39) $\vec{A} = 5\hat{k} \Rightarrow |A| = \sqrt{5^2} = 5$ (b)

Q (40) (m , kg , s)

(length, mass , time) (b)

Q (41) $X = 10 + t^2 \Rightarrow v = \frac{dx}{dt} = 2t \Rightarrow a = \frac{dv}{dt} = 2\ m/s^2$ at any time (c)

Q (42) a)



$F_N + F = mg$

$F_N = mg - F$

$F_N = mg + F$

$F_N + F\sin\theta = mg$

$F_N = mg - F\sin\theta$

$F_N = mg$

(d)

Q (43) $A = -B$

A and B equals in mag. and oppose (dir.) (b)

Q (44) $\Delta r = 2\hat{i} - 3\hat{j} + 6\hat{k}$

$r_2 = 3\hat{j} - 4\hat{k}$

$\Delta r = (+2)\hat{i}\ (-3)\hat{j}\ (+6)\hat{k}$

$\Delta r = r_2 - r_1$

$r_1 = r_2 - \Delta r$

$r_1 = -2\hat{i} + 6\hat{j} - 10\hat{k}$ (d)

King Abdulaziz University
Faculty of Sciences
Physics Department

Final Exam - PHYS 110

Second Term
1433-1434 H

Date : 11 / 7 / 1434 H

A

Name: ____________ **ID No:** ____________ **Section:** ________

Choose The Correct Statement (True) or (False) :

1. A microsecond = 10^{-9} s
   A) True (B) False

2. If the body starts from the rest , its initial velocity is taken as maximum value.
   A) True (B) False

3. A baseball is thrown vertically into air, the acceleration of the ball at the highest point is zero.
   A) True (B) False

4. Hooke's law is : $F_x = -kx$
   (A) True B) False

5. The law of conservation of liner momentum is ($\vec{P}_i = \vec{P}_f$).
   (A) True B) False

6. The magnitude of the unit vector equals zero.
   A) True (B) False

7. The component of a vector is the projection of the vector (مسقط المتجه) on an axis.
   (A) True B) False

8. Speed is the magnitude of velocity.
   (A) True B) False

9. Energy transferred to an object is positive work.
(A) True B) False

10. The value of $\hat{k} \cdot \hat{k}$ is 1
(A) True B) False

11. Km / h^2 is a unit of velocity.
A) True (B) False

12. The mass of a body is different from place to place on the Earth.
A) True (B) False

13. The free fall motion is an example of motion along a straight line with constant acceleration.
(A) True B) False

14. A displacement of a particle moves from $x_1 = -20\,m$ to $x_2 = 18\,m$ is positive.
(A) True B) False

Choose The Correct Answer :

Use the following to answer questions 15-16:

A force of 10 N works on a ball over a distance of 3 m.

15. If the force is parallel to the displacement of the ball. The work done by the force is :

A) 0 J B) 2 J (C) 30 J D) -30 J

16. If the force is perpendicular to the displacement of the ball. The work done by the force is:

A) 2 J B) -30 J C) 30 J (D) 0 J

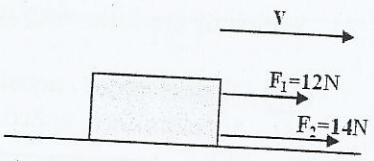
---

17. The magnitude of the force acting on an object of mass 0.03 kg moving with 0.6 m/s in a circle of radius 0.5 m is:

A) $2.2\times10^{-2}\,N$ B) $6.5\times10^{-4}\,N$ C) $4.7\times10^{-4}\,N$ D) $3.6\times10^{-2}\,N$

---

18. In the figure F_1 and F_2 acting on a box sliding to the right across a frictionless floor with velocity v=2 m/s



The net power due to F_1 and F_2 acting on a box is :

A) 24 W   B) 0 W   C) 28 W   D) 52 W

---

19. A projectile is fired with velocity $\vec{v}_0 = 250\hat{i}\ m/s$ from a gun that 60 m above the ground, its velocity component v_x before it reaches the ground is :

A) 176.8 m/s   B) 120 m/s   C) 216.5 m/s   D) 250 m/s

---

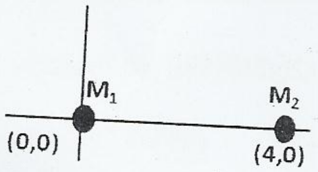
20. The velocity of a particle moving along the x axis changes from v_i to v_f. For which situations the work done on the particle is positive.

A) v_i = -6 m/s, v_f = -4 m/s
B) v_i = 5 m/s, v_f = -5 m/s
C) v_i = 2 m/s, v_f = -5 m/s
D) v_i = 6 m/s, v_f = -3 m/s

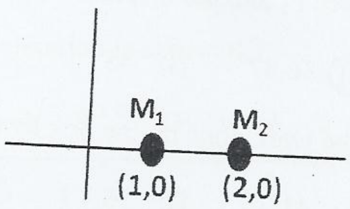
---

21. In which figure of the following is X_{com} = 2m ? ($M_1 = M_2 = 1$ kg)

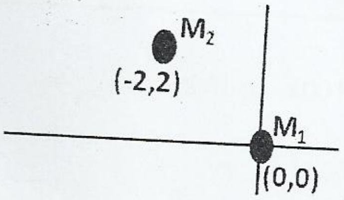
A)



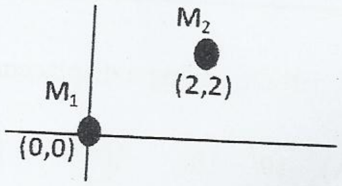
C)



B)



D)



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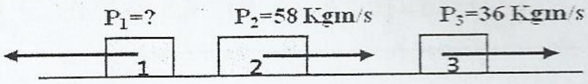
22. A box of mass m=17 kg slides with speed v= +5 m/s across a frictionless floor, suddenly explodes into three pieces.The figure shows after explosion the momenta of the two pieces, what is the momentum of the first box ?



A) -28 Kg.m/s (B) -9 Kg.m/s C) -96 Kg.m/s D) -4 Kg.m/s

---

23. Which of the following groups does not contain a scalar quantity ?

(A) Displacement , acceleration , force
B) Acceleration , speed, work
C) Energy, work , distance
D) Velocity , force , power

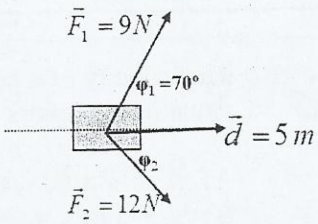
---

24. A kilowatt-hour is a unit of:

A) energy/time (B) work C) power/time D) power

Use the following to answer questions 25-26:

The figure shows two forces applied to a box that moves to the right over a frictionless floor.



25. If the work done on the box by the force F_2 is W_2=48 J, the angle φ_2 between the force F_2 and the displacement d is:

(A) 36.87° B) 45° C) 20.31° D) 26.55°

26. The work done on the box by the force F_1 is:

A) 41.3 J B) 56.4 J C) 20.5 J (D) 15.4 J

---

27. A particle having a displacement $\Delta\vec{r} = 10\hat{i} - 100\hat{k}$ in 10 s , its $\vec{v}_{avg}$ =

A) $10\hat{i} - 10\hat{k}$ (B) $\hat{i} - 10\hat{k}$ C) $10\hat{i} - \hat{k}$ D) $\hat{i} - \hat{k}$

---

28. The linear momentum of a moving particle is given by $p(t) = 3t + 4$. the net force on the particle is :

A) 4 N B) 7 N C) 3N D) 0 N

---

29. The work done by force $\vec{F} = (10N)\hat{i} - (15N)\hat{j}$, that moves a particle from a position $\vec{r}_i = (-2m)\hat{i}$ to a position $\vec{r}_f = (4m)\hat{i}$ is:

A) 195 J B) 75 J C) 135J D) 60 J

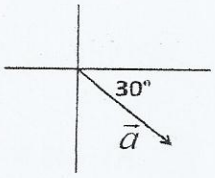
---

30. $\vec{A} = 3\hat{i} + 4\hat{j}$ and $\vec{B} = -5\hat{i} - 7\hat{j}$, then $\vec{A} + \vec{B} =$

A) $8\hat{i} - 11\hat{j}$ B) $2\hat{i} + 3\hat{j}$ C) $\vec{A} = 3\hat{i} + 4\hat{j}$ D) $-2\hat{i} - 3\hat{j}$

---

31. In the figure, the vector $\vec{a}$ has a magnitude of 12 units . Its y-component a_y is equal to :



A) -12 B) 12 C) 6 D) -6

---

32. Car A has a mass of 1000 Kg and a speed of 60 Km/h , and car B has a mass of 2000 Kg and a speed of 30 Km/h . The kinetic energy of car A is .....

A) equal that of car B
B) twice (مرتين) that of car B
C) four times that of car B
D) half that of car B

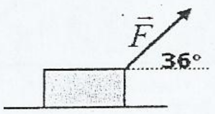
---

33. In which of the following situations the acceleration is constant ?

A) $v = 5t^4$ B) $v = 2t + 3$ C) $v = -4t + 3t^2$ D) $v = 6 + 2t - 4t^3$

---

34. If the force $\vec{F} = 100N$ is applied to a block ,but the block does not move, what is the magnitude of the static frictional force f_s on it ?



A) 30 N B) 81 N C) zero D) 50 N

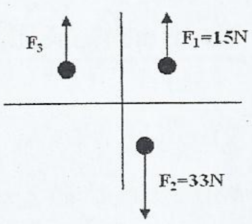
---

35. In the projectile motion the maximum range is :

A) $\frac{v_0^2}{g}$ B) $\frac{v_0^2 \sin 60^\circ}{g}$ C) $\frac{v_0^2 \sin 120^\circ}{g}$ D) $\frac{v_0^2 \sin 30^\circ}{g}$

---

36. In the figure , what is the magnitude of the force F_3 acting on particle 3 if the center of mass of the system is stationary

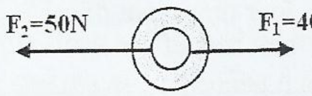


A) -48 N B) 48 N C) 18 N D) -18 N

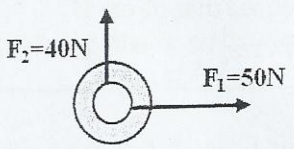
---

37. A 10 kg tire (إطار) that is to be pulled by two ropes. In which figure the acceleration of the tire is $a_x = +1 m/s^2$?

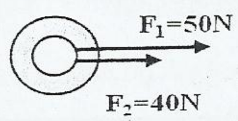
A)



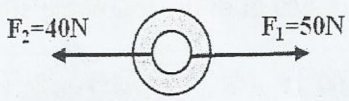
C)



B)



D)



---

38. A car is moving with a velocity of 27 m/s. If its momentum is 21600 kg.m/s, what is its mass ?

A) 1200 Kg B) 800 Kg C) 80 Kg D) 500 Kg

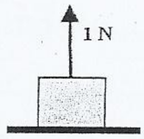
---

39. A block lies on a frictionless floor attached to a spring with k=750 N/m , how much work does the spring force do on the block if it is pulled from x_1=0.017m to x_2= -0.012 m?

A) 0.32 J B) 0.12 J C) 0.05 J D) 0.16 J

---

40. A 1N upward force is applied to a block of weight 3N as shown in the figure , but the block is still at rest. The y-component ($f_{net,y}$) of the net force on the block is :



A) F_N+(1N)+(-3N) B) F_N+(1N)+(3N) C) (1N)+(3N) D) F_N

---

41. The gravitational force of earth acting on a 1Kg is:

A) 980 N B) 40 N C) 9.8 N D) 0 N

---

42. A boy lifts (رفع) a 3.5 Kg box upward a distance 0.3 m , the work done by the gravitational force on a box is:

A) +1.05 J B) -10.29 J C) +10.29 J D) -1.05 J

---

43. A particle moves in a circle of radius r = 15m .The distance that the particle moved in one turn is:

A) 47.1 m B) 15 m C) 295.8 m D) 94.2 m

---

44. Rank (رتبي) the situations according to the kinetic energy of a particle of mass m has the following velocities (greatest first).

situation	velocity
A	$\vec{v}=-4\hat{i}-3\hat{j}$
B	$\vec{v}=5\hat{j}$
C	$\vec{v}=5\hat{i}$
D	$\vec{v}=3\hat{i}+4\hat{j}$

A) C-A-B-D B) A-B-C-D C) all the same D) B-C-A-D

A

Final Exam — Second Term — 1433-1434H

11-7-1434H

1. B) false — A microsecond $= 10^{-6}$ s

2. B) false — its initial velocity is taken as zero.

3. B) false — the acceleration at the highest point is (9.8 m/s²)

4. A) True

5. A) True

6. B) false — The magnitude of unit vector equals one.

7. A) True

8. A) True

9. A) True

10. A) True

11. B) false — Km/h^2 is a unit of acceleration.

12. B) false — The mass of a body is the same from ------

13. A) True

14. A) True — $\Delta x = 18 - (-20) = +38\ m$ Positive.

$F = 10 N$ $\quad d = 3 m$

15. C) 30 J

$\vec{F} \rightarrow$, $\vec{d} \rightarrow$ $\quad \phi = 0°$

$$W = F d \cos(0°) = (10)(3)(1) = 30 J$$

16. D) 0 J

$\vec{F} \uparrow$, $\vec{d} \rightarrow$ $\quad \phi = 90°$

$$W = F d \cos(90°) = (10)(3)(0) = 0 J$$

---

17. A) $2 \times 10^{-2} N$

$m = 0.03 kg$, $v = 0.6 m/s$

$r = 0.5 m$

$$F = m\left(\frac{v^2}{r}\right) = (0.03)\left(\frac{(0.6)^2}{0.5}\right)$$

$$= 0.0216 \approx 2 \times 10^{-2} N$$

---

18. D) 52 W

$v = 2 m/s$, $F_1 = 12 N$

$F_2 = 14 N$

$$P_{net} = P_1 + P_2 = F_1 v \cos(0) + F_2 v \cos(0)$$

$$= 12(2)(1) + 14(2)(1) = 52 W$$

---

19. D) 250 m/s

$\vec{V} = 250 \hat{i}$ m/s

$V_x = 250$ m/s

V_x = constante

---

20. C) $v_i = 2$ m/s
$v_f = -5$ m/s

$$W = K_f - K_i = \frac{1}{2}m(v_f^2 - v_i^2)$$

$$A)\ W = \frac{1}{2}m\left[(-4)^2 - (-6)^2\right] = -$$

$$B)\ W = \frac{1}{2}m\left[(-5)^2 - (5)^2\right] = 0$$

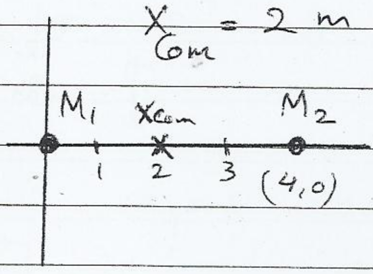
$$C)\ W = \frac{1}{2}m\left[(-5)^2 - (2)^2\right] = +$$

$$D)\ W = \frac{1}{2}m\left[(-3)^2 - (6)^2\right] = -$$

---

21. A)

$X_{com} = 2$ m

A) 

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22. B) -9 kg·m/s

$m = 17$ kg $\quad v = 5$ m/s

$$P_i = P_f$$
$$P_i = P_1 + P_2 + P_3$$
$$mv = P_1 + 58 + 36$$
$$P_1 = mv - 58 - 36 = (17)(5) - 58 - 36$$
$$P_1 = -9 \text{ kg·m/s}$$

---

23. A)

A) Displacement, acceleration, force
B) Acceleration, speed, work
C) Energy, work, distance
D) velocity, force, power

24. B) Work

Kilowatt - hour is a unit of work

10^3 watt . 3600 s = $10^6 \times 3.6$ Watt . s

3.6×10^6 J

$F_1 = 9N$ $\phi_1 = 70°$

$F_2 = 12N$ $\phi_2 = ?$

$\vec{d} = 5m$

25. A) 36.87°

$W_2 = 48J$

$W_2 = F_2 d \cos\phi_2$

$\phi_2 = \cos^{-1}\left(\frac{W_2}{F_2 d}\right) = \cos^{-1}\left(\frac{48}{12(5)}\right) = 36.87°$

26. D) 15.4 J

$W_1 = F_1 d \cos\phi_1 = 9(5)\cos 70°$

$= 15.39 \approx 15.4$ J

27. B) $\hat{i} - 10\hat{k}$

$\vec{v}_{avg} = \frac{\Delta\vec{r}}{t} = \frac{10\hat{i}}{10} - \frac{100\hat{k}}{10}$

$= \hat{i} - 10\hat{k}$

28. C) 3N

$P(t) = 3t + 4$

$F_{net} = \frac{dP}{dt} = 3N$

29. D) 60 J

$\vec{F} = (10N)\hat{i} - (15N)\hat{j}$

$\vec{d} = \vec{r}_f - \vec{r}_i = 4\hat{i} - (-2)\hat{i}$

$= 6\hat{i}\,m$

$W = \vec{F}\cdot\vec{d} = (10N)\hat{i} - (15N)\hat{j} \cdot 6\hat{i}$

$= 60\,\hat{i}\cdot\hat{i} = 60\ J$

---

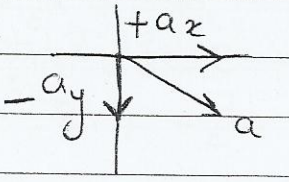
30. D) $-2\hat{i} - 3\hat{j}$

$\vec{A} + \vec{B} = 3\hat{i} + 4\hat{j} - 5\hat{i} - 7\hat{j}$

$= -2\hat{i} - 3\hat{j}$

---

31. D) -6



$a_y = a \sin 30°$

$= 12 \sin 30 = 6$

$= -6$

---

32. B) twice that of car B

$A \rightarrow m = 1000 kg$, $V = 60 km/h$

$B \rightarrow m = 2000 kg$, $V = 30 km/h$

$A \Rightarrow \frac{1}{2} m V^2 = \frac{1}{2}(1000)(60)^2 = 18 \times 10^5 J$

$B \Rightarrow \frac{1}{2} m V^2 = \frac{1}{2}(2000)(30)^2 = 9 \times 10^5 J$

---

33. B) $V = 2t + 3$

A) $V = 5t^2 \rightarrow a = 10t\ m/s^2$

B) $V = 2t + 3 \rightarrow a = 2\ m/s^2$

C) $V = -4t + 3t^2 \rightarrow a = -4 + 6t\ m/s^2$

D) $V = 6 + 2t - 4t^3 \rightarrow a = 2 - 12t^2\ m/s^2$

---

34. B) 81 N

the block does not move

$$f_s = F_x = F\cos 36 = 100\cos 36 = 80.9 \approx 81\ N$$

---

35. A) $\frac{V_0^2}{g}$

$$R_{max} = \frac{V_0^2(\sin 2\theta_0)}{g} = \frac{V_0^2}{g}$$

$\theta_0 = 45^\circ \Rightarrow \sin 2\theta_0 = 1$

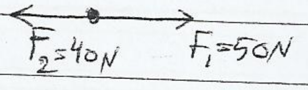
---

36. C) 18 N

$$F_1 + F_2 + F_3 = 0$$
$$+15 - 33 + F_3 = 0$$
$$F_3 = +18$$

---

37. D)



$m = 10\ kg$

$a_x = +1\ m/s^2$

A) $\frac{F_1 - F_2}{M} = \frac{40 - 50}{10} = -1\ m/s^2$

B) $a_x = \frac{+F_1 + F_2}{m} = \frac{50 + 40}{10} = \frac{90}{10} = 9\ m/s^2$

C) $a_x = \frac{+F_1}{m} = \frac{50}{10} = 5\ m/s^2$

D) $a_x = \frac{F_1 - F_2}{m} = \frac{50 - 40}{10} = \frac{10}{10} = +1\ m/s^2$

38. B) 800 kg

$v = 27$ m/s

$P = 21600$ kg m/s

$$P = mv$$

$$m = \frac{P}{v} = \frac{21600}{27} = 800 \text{ kg}$$

---

39. C) 0.05 J

$k = 750$ N/m

$x_1 = 0.017$ m

$x_2 = -0.012$ m

$$W_s = \frac{1}{2}k\left(x_1^2 - x_2^2\right) = \frac{1}{2}(750)\left[(0.017)^2 - (-0.012)^2\right]$$

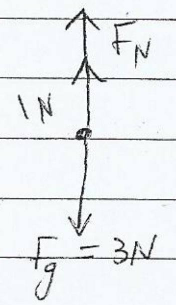
$$= \frac{1}{2}(750)\left[(2.89\times10^{-4}) - (1.44\times10^{-4})\right] = 543.75\times10^{-4} \text{ J}$$

$$= 0.05 \text{ J}$$

---

40. A) $F_N + 1N - 3N$

the block is at rest



$$F_{net,y} = F_N + 1N - 3N$$

---

41. C) 9.8 N

$$F_g = mg = 1(9.8) = 9.8 \text{ N}$$

---

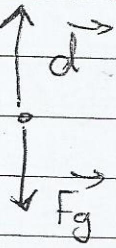
42. B) -10.29

$m = 3.5\ kg$

$d = 0.3\ m$

$\phi = 180°$

$\cos\phi = -1$



$W_{F_g} = -mgd = -10.29$

---

43. D) 94.2 m

$r = 15\ m$

$2\pi r = 2(3.14)(15) = 94.2\ m$

---

44. C) all the Same

A) $|V| = \sqrt{(-4)^2 + (-3)^2} = 5$

B) $|V| = \sqrt{5^2} = 5$

C) $|V| = \sqrt{5^2} = 5$

D) $|V| = \sqrt{3^2 + 4^2} = 5$

د. خلود أحمد ١٢

الامتحان النهائي للعام ١٤٣٣-١٤٣٤ - الترم الأول

King Abdulaziz University
Faculty of Sciences
Physics Department

Final Exam - Physics 110

First Term
1433-1434 H

Date: 19 / 2 / 1434H

D

Name: ID No: Section:

CHOOSE THE CORRECT ANSWER

1. In free falling, if an apple and a stone are freely falling, the acceleration of the apple is greater than the acceleration of the stone.

a) True **(b)** False

In free falling, the acceleration of the apple is equale the acceleration of the stone.

2. A particle moved a displacement $\Delta\vec{r} = (12m)\hat{i} + (3m)\hat{k}$ in 2 seconds. Its average velocity is $6\hat{i} + 1.5\hat{j}$

$\bar{V}_{avg} = \frac{\Delta\bar{r}}{\Delta t} = \frac{12\hat{i} + 3k}{2} = 6\hat{i} + 1.5\hat{k}$

a) True **(b)** False

3. Acceleration is defined as the rate of change of position with time

a) True **(b)** False

Acceleration is defined as the rate of change of velocity with time

4. The value of $\hat{i} \times \hat{j} = 1$

$\hat{i} \times \hat{j} = \hat{k}$

a) True **(b)** False

5. The angle between $\vec{A} = (25m)\hat{i} + (45m)\hat{j}$ and the positive x axis is 61^0

(a) True b) False

$\theta = \tan^{-1}\frac{A_y}{A_x} = \tan^{-1}\frac{45}{25} \approx 61^0$

6. A particle is in uniform circular motion if it travels around a circle at constant speed

(a) True b) False

7. 3.68 micrometer = 3.68×10^{-9} m

a) True **(b)** False

3.68 micrometer = 3.68×10^{-6} m

8. A car travels at constant velocity. The net force on the car is zero

(a) True b) False

9. A force of 1 N = 1 kg m/s^2

(a) True b) False

10. When the object is stationary, its kinetic energy is zero.

(a) True b) False

11. In which situation of the following the acceleration is constant ?

Situation	Velocity of the particle
1	$v = -t + 2t^2$
2	$v = 8t + 5$
3	$v = 5t^4$
4	$v = 2 + 2t - t^3$

$a = \frac{dv}{dt}$; $a = -1 + 4t$; $a = 8 \Rightarrow$ constant; $a = 20t^3$; $a = 2 - 3t^2$

a) 1 b) 3 (c) 2 d) 4

12. If a particle moves along the x axis according to the equation $x = 4t^2$, where x is in meters and t is in seconds. Then:

$v = 8t$ m/s, $a = 8$ m/s^2

a) $a = 8\ t(m/s^2)$ (b) $a = 8\ (m/s^2)$ c) $v = 4\ (m/s)$ d) $v = 4\ t(m/s)$

13. A system consists of three particles having the following coordinates:

	mass (kg)	x (cm)	y (cm)
Particle 1	1	3	2
Particle 2	2	0	0
Particle 3	2	- 4	0

$x_{com} = \frac{m_1x_1 + m_2x_2 + m_3x_3}{M} = \frac{1(3) + (2)(0) + 2(-4)}{5} = \frac{3-8}{5} = -1$ cm

$y_{com} = \frac{m_1y_1 + m_2y_2 + m_3y_3}{M} = \frac{1(2) + 2(0) + 2(0)}{5} = 0.4$ cm

The center of mass of the three particle system has the coordinates:

a) x_{com}= 2.6 cm, y_{com}= 1.6 cm
(b) x_{com}= - 1 cm, y_{com}= 0.4 cm
c) x_{com}= 0.6 cm, y_{com}= 2 cm
d) x_{com}= - 2 cm, y_{com}= 3 cm

14. The work done by gravity F_g on an object of mass m during the downward falling is :

a) zero b) – mgd c) F_g (d) mgd

$W_{Fg} = F_g d \cos 0° = mgd$

15. A boy of 71 kg running in a circular path of R=2 m at a velocity of 8 m/s. The centripetal force is:

$F = m(\frac{v^2}{R}) = 71(\frac{8^2}{2}) = 2272$ N

(a) 2272 N b) 4096 N c) 408 N d) 645 N

16. A particle moves along an x axis, if the particle's velocity changes from -5 m/s to -3 m/s, then the kinetic energy of the particle

a) equals zero b) remains the same c) increases (d) decreases

$K_i = \frac{1}{2}mv_i^2 = \frac{1}{2}m(-5)^2 = 12.5m$ J

$K_f = \frac{1}{2}mv_f^2 = \frac{1}{2}m(-3)^2 = 4.5m$ J

17. A particle of mass m moves around a circle of radius r with constant speed v. The period of its motion is:

a) $T = \frac{\pi r^2}{v}$ **b)** $T = \frac{2\pi r}{m}$ **c)** $T = \frac{2\pi\, v}{r}$ **d)** $T = \frac{2\pi r}{v}$

18. The equation F_{net} = M a_{com} is Newton's second law for the motion of the center of a system of particles where:

a) F is the net internal force and M is the total mass of the system
b) F is the net external force and M is the total mass of the system
c) F is the gravitational force and M is the total mass of the system
d) F is the net internal force and M is the mass acting on the system

19. A force acted on a spring of length 0.3 m and compressed it (انضغط) to 0.25 m. If the spring constant is k = 50 N/m, the work done by the spring is:

a) 0.69 J **b)** 10 J **c)** 0.55 J **d)** 1.6 J

20. A 6 kg object is moving with a net force of 36 N-north acting on it. The object having an acceleration of:

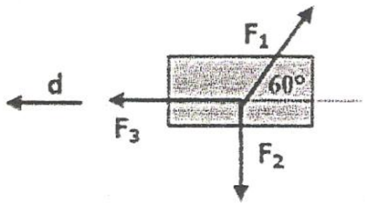
a) 6 m/s², north **b)** 6 m/s², south **c)** 58.8 m/s², south **d)** 58.8 m/s², north

21. What is the initial velocity of a particle moving with a constant acceleration of 5 m/s² if it has a velocity of 9 m/s after 1 second ?

a) 41 m/s **b)** 4 m/s **c)** 6 m/s **d)** 7 m/s

Use the following to answer questions 22-24:

The figure shows three forces applied to a box of mass m=255 kg that moves to the left for a distance d=2 m over a frictionless floor.



22. The net work done on the box by the three forces is:

a) $W_{net} = F_1 d\cos 120 + F_2 d + F_3 d$
b) $W_{net} = F_1 d\cos 120 + F_3 d$
c) $W_{net} = F_1 d\cos 60 + F_2 d + F_3 d$
d) $W_{net} = F_1 d\cos 60 + F_2 d + F_3 d\cos 120$

23. If the box was initially stationary, what is its speed v_f at the end of the displacement?

a) $v_f = \sqrt{\frac{W_{net}}{2m}}$ **b)** $v_f = \sqrt{\frac{2m}{W_{net}}}$ **c)** $v_f = \sqrt{\frac{2\,W_{net}}{m}}$ **d)** $v_f = \sqrt{\frac{m}{2\,W_{net}}}$

24. What is the work done on the box by the normal force from the floor? $W_{F_N} = F_N d \cos 90^\circ = 0$

a) W_{F_N} = 9800 J **b)** W_{F_N} = 4998 J **c)** W_{F_N} =2499 J **(d)** W_{F_N} = zero

Use the following to answer questions 25-27:

Given two vectors $\vec{A} = 2\hat{i} + 2\hat{j}$, and $\vec{B} = 3\hat{i} - 4\hat{j}$:

25. $\frac{1}{4}\vec{A} =$ $\frac{1}{4} \times 2\hat{i} + \frac{1}{4} \times 2\hat{j} = 0.5\hat{i} + 0.5\hat{j}$

a) $0.5\hat{i} + 4\hat{j}$ **b)** $2\hat{i} + 2\hat{j}$ **c)** $\hat{i} + 2\hat{j}$ **(d)** $0.5\hat{i} + 0.5\hat{j}$

26. The magnitude of $\vec{B}$ $|B| = \sqrt{(3)^2 + (-4)^2} = 5$

a) 4 **b)** 6 **c)** 3 **(d)** 5

27. $\vec{A} \cdot \vec{B}$ equals: $\vec{A} \cdot \vec{B} = 2(3)\hat{i}\cdot\hat{i} + 2(-4)\hat{j}\cdot\hat{j} = 6 - 8 = -2$

a) -4 **b)** +3 **(c)** -2 **d)** +5

28. A 5 kg body moving with velocity 3 m/s, and a 4 kg body moving with velocity 2 m/s along the x axis. Find the total linear momentum of the system of the two bodies?

a) 8 kg m/s **(b)** 23 kg m/s **c)** 15 kg m/s **d)** 7 kg m/s

$P = P_1 + P_2 = m_1 v_1 + m_2 v_2 = 5(3) + 4(2) = 23$ kg.m/s

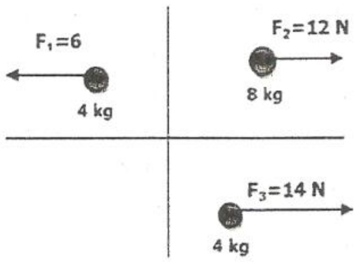
29. An 8 kg cart (عربة) changes its speed from 2 m/s to 5 m/s. The net work done on the cart must be:

$W = \frac{1}{2} m [v_f^2 - v_i^2] = \frac{1}{2}(8)[(5)^2 - (2)^2] = 84$ J

a) 32 J **(b)** 84 J **c)** 20 J **d)** 89 J

30. In the figure, three objects are subjected to external forces. The x-component of acceleration of the center of mass $a_{com,x}$ is:

$a_{com,x} = \frac{F_{1x} + F_{2x} + F_{3,x}}{M} = \frac{-6 + 12 + 14}{4 + 8 + 4} = 1.25$ m/s^2



a) $a_{com,x}$ = 1.63 m/s^2 **c)** $a_{com,x}$ = 2.03 m/s^2

(b) $a_{com,x}$ = 1.25 m/s^2 **d)** $a_{com,x}$ = 1.45 m/s^2

Use the following to answer questions 31-32:

A particle of mass = 2 kg is being accelerated along a straight line at 4 m/s^2. If the particle has an initial speed of 3 m/s and travels a distance 0.1 m

31. The speed of the particle at the end of the displacement is: $V^2 = V_0^2 + 2a(x - x_0)$

$V^2 = 3^2 + 2(4)(0.1) = 9.8$

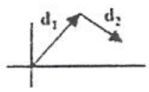
$V = 3.1 \text{ m/s}$

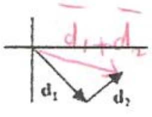
a) 3.1 m/s **b)** 5.2 m/s **c)** 8.3 m/s **d)** 2.9 m/s

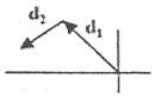
32. The initial kinetic energy is: $K_i = \frac{1}{2} m V_i^2 = \frac{1}{2}(2)(3)^2 = 9J$

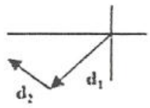
a) 2 J **b)** 4 J **c)** 7 J **d)** 9 J

33. In Which figure of the following, the sign of the x and y components of the vector $(\bar{d}_1 + \bar{d}_2)$ is (+ , -)? (x, y)

a) 

b) 

c) 

d) 

34. Which of the following is a scalar physical quantity ?

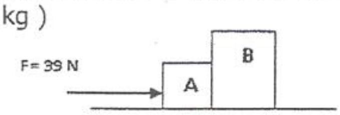
a) Linear momentum **b)** Velocity **c)** Force **d)** Power

35. A cannon projected ball with initial speed $v_0 = 35$ m/s. What is the maximum range of the cannon ball? $\sin 90^\circ = 1$

$R_{max} = \frac{V_0^2}{g} = \frac{(35)^2}{9.8} = 125 m$

a) 125 m **b)** 357 m **c)** 180 m **d)** 343 m

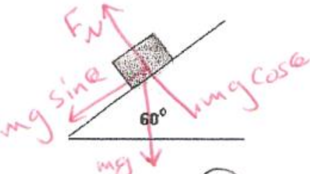
36. Two blocks are in contact on a horizontal frictionless surface. A 39 N constant force is applied to block A as shown.($m_A = 11$ kg, $m_B = 20$ kg)



The acceleration of the system of the two blocks is: $a = \frac{F}{m_A + m_B} = \frac{39}{11+20} = 1.25 m/s^2 \approx 1.3 m/s^2$

a) 5.4 m/s² **b)** 1.3 m/s² **c)** 4.5 m/s² **d)** 2.5 m/s²

37. A 100 kg mass is sliding on frictionless plane inclined at $\theta = 60^\circ$, the magnitude of F_N is:

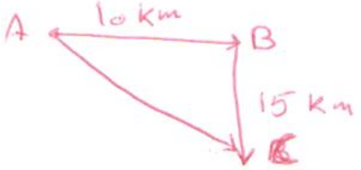


$F_N = mg\cos\theta = 100(9.8)\cos 60^\circ$
$= 490 N$

a) 530 N **b)** 490 N **c)** zero **d)** 215 N

38. A car moves 10 km east from city A to city B, then 15 km south from city B to city C. The magnitude of the car's displacement from A to C is:

a) 14 km **b)** 18 km **c)** 11 km **d)** 20 km



displacement $= \sqrt{(10)^2 + (15)^2}$
$= 18.03$ km
≈ 18 km

39. A force $\vec{F}=4N\hat{i}+2N\hat{j}-4N\hat{k}$ is applied to a block that moves a distance $\vec{d}=(5m)\hat{i}$ over a frictionless surface , the work done on the block by the force is :

a) 30 J **b)** 10 J **c)** 50 J **(d))** 20 J

$W = F.d = 4(5)\hat{i}.\hat{i} = 20\,J$

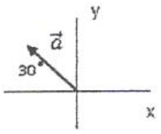
40. In which figure of the following $a_x = -7.66m$? where $a = 10m$

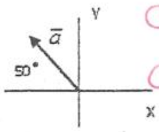
$a_x = a\cos\theta$

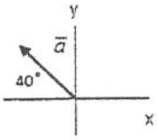
$\theta = \cos^{-1}\frac{a_x}{a} = \cos^{-1}\left(\frac{-7.66}{10}\right)$

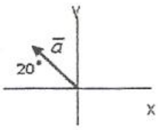
$\theta = 139.9 \simeq 140°$

$180-140 = 40°$

a) 

c) 

(b)) 

d) 

41. A box of mass 30 kg is in motion along a horizontal floor. If $\mu_k = 0.6$, the magnitude of the kinetic frictional force (f_k) between the box and the floor is:

$f_k = \mu_k F_N = \mu_k mg = (0.6)(30)(9.8) = 176.4\,N$

a) 294 N **(b))** 176.4 N **c)** 18 N **d)** 61 N

42. A 12 N force does a work of 30 J on a particle as the particle moves through a displacement 5 m. The angle between the force and the displacement is: $W = Fd\cos\theta$

a) 80^0 **(b))** 60^0 **c)** 27^0 **d)** 45^0

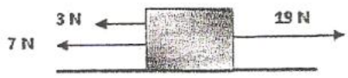
$\varphi = \cos^{-1}\frac{W}{Fd} = \cos^{-1}\frac{30}{12(5)} = 60°$

43. A block is pulled at constant speed of 8 m/s across a horizontal floor by an applied force of 220 N directed 55^0 above the horizontal. The power on the block is:

$P = Fv\cos\varphi = 220(8)\cos(55°) = 1009.49W \simeq 1009\,W$

(a)) 1009 W **b)** 458.9 W **c)** 126.2 W **d)** 1760 W

44. In the figure, the magnitude of the net force on the block is:



$F_{net} = 19 - 3 - 7 = 9\,N$

a) 10 N **(b))** 9 N **c)** 11 N **d)** 12 N

KING ABDULAZIZ UNIVERSITY
FACULTY OF SCIENCE
Physics Department
Summer Term
Final Exam

A

Phys 110

Student Name :	Student Number:	Group:
Section:		

Choose The Correct Statement (True) or (False)?

1. In projectile motion the horizontal acceleration is Zero.
   a) True   b) False

2. The horizontal range R is maximum for a launch angle of 90
   a) True   b) False

3. A nanosecond is 10^8 s
   a) True   b) False

4. If no net force acts on a body .the body's velocity cannot change , then the body cannot accelerate.
   a) True   b) False

5. The instantaneous acceleration is $\vec{a} = \frac{\vec{v}_1 - \vec{v}_2}{\Delta t}$
   a) True   b) False

6. The magnitude of $\vec{f}_s$ has maximum value that is given by: $f_{smax} = \mu_s F_N$
   a) True   b) False

7. The value of $\hat{k} \cdot \hat{i}$ is Zero .
   a) True   b) False

8. The magnitude of the gravitational force is equal to the product (ma).
   a) True   b) False

9. The SI unit of kinetic energy is: $kg.m/s^2$.
   a) True   b) False

10. In Newton's 2^{nd} law, the net force and acceleration are in the same directions.
    a) True   b) False

11. The velocity is defined as the change in position from initial position to final position.
    a) True   b) False

12. Watt is equal to: Joule per second
    a) True   b) False

13. The SI base unit for mass is gram.
a) True
b) False

14. The angle between the vector $\vec{A}$ given by; $\vec{A} = (25m)\hat{\imath} + (45m)\hat{\jmath}$ and the positive x-axis is: 61^o.
a) True
b) False

15. A 5kg object moving at a speed of 6 m/s, its kinetic energy is 80 Joule.
a) True
b) False

16. The time rate of change of the linear momentum of a particle is equal to the net force acting on it (**i.e** $\vec{F}_{net} = \frac{d\vec{P}}{dt}$**).**
a) True
b) False

Choose the Correct Answers :

17. A man weighing 800 N is standing in an elevator moving with a constant velocity. The force exerted by the man on the floor of the elevator is:
a) less than 80 N
b) 800 N
c) between 80 and 800 N
d) more than 800 N

18. What is the speed of a 55 kg woman running with a kinetic energy of 412.7 J?
a) 15 m/s
b) 3.87 m/s
c) 2.7 m/s
d) 4 m/s

19. A ball kicked with a velocity of 15 m/s and with an angle of $\theta = 45^o$ from the horizontal. The maximum range is:
a) 25.85 m
b) 40.82m
c) 50.20 m
d) 22.96 m

20. In the projectile motion, the maximum range is:
a) $\frac{v_0^2}{g}(\cos\theta)$
b) $\frac{v_0^2}{g}$
c) $\frac{v_0}{g}$
d) $\frac{v_0^2}{g}(\cos\theta)^2$

21. A man stands on the groun, if his mass is 80 kg, his weight is:
a) 7.84 N
b) 784 N
c) 78.4 N
d) 7840 N

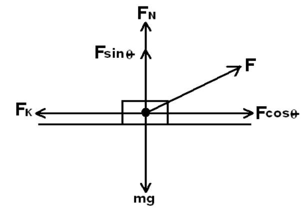
22. Having two vectors $\vec{A} = 2\hat{i} + 3\hat{j}$ and $\vec{B} = \hat{i} - 2\hat{j} + \hat{k}$, the result of $\vec{A} \times \vec{B}$ is:
a) $3\hat{\imath} + 5\hat{\jmath} - 3\hat{k}$
b) 0
c) $3\hat{i} - 2\hat{j} - 7\hat{k}$
d) $\hat{i} - \hat{j}$

23. One Newton (1 N) in SI is equal to
a) $\frac{1\ kg.m}{s}$
b) $\frac{1\ kg.m}{s^2}$
c) $\frac{1\ kg.cm}{s}$
d) $\frac{1\ g.m}{s}$

24. The position of a car changes from $x_1 = 30m$ to $x_2 = 120m$ in the time interval from 2s to 4s , the average velocity of the car is :
a) 30m/s
b) 40m/s
c) 20 m/s
d) 45m/s

25. An object dropped from a height of 80m, its speed after 3 s is:
a) 33 m/s b) -29.4m/s c) -9.8 m/s d) 39.5m/s

26. The expression that represents a stationary box in the figure is:



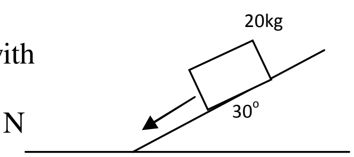
a) $F_N + F\sin\theta = mg$
b) $F_N - F\sin\theta = mg$
c) $F\cos\theta$ - $F_k = mg$
d) $F_N + F\cos\theta - mg$

27. If $\vec{A} = 2\hat{\imath} + 2\hat{\jmath}$ and $\vec{B} = 2\hat{\imath} - 4\hat{\jmath}$, the resultant vector $\vec{A} + \vec{B}$ is:
a) $2\hat{\imath}+4\hat{\jmath}$ b) $4\hat{\imath}-2\hat{\jmath}$ c) $4\hat{\imath}+2\hat{\jmath}$ d) $2\hat{\imath}-4\hat{\jmath}$

28. if A=10 units and B=6 units, the angle between them is 60^o, the dot product of the vectors ($\vec{A} \cdot \vec{B}$) is:
a) 20 unit b) 30 unit c) 51.96 unit d) 60 unit

29. A force was applied on an object of mass 50 kg with speed 32 m/s, the linear momentum is:
a) 1600 kg.m/s b)1900 kg.m/s c) 1500 kg.m/s d)1700 kg.m/s

30. A 20 kg object is sliding down in an incline smooth plane with 30^o with the horizontal , the net force in direction of sliding is:



a) 49N b) 98 N c) 196 N d) 294 N

31. A force acts on a spring with length 30 cm. This force compressed it by 25cm. The spring constant is k=50 N/m, the work done by the spring is:
a)10 joule b) 1.6 joule c) 0.69 joule d) 0.55 joule

32. An object is moving in the positive direction of the x-axis with a relationship $x(t)=8+2t+3t^2$, the instantaneous velocity after $2s$ is:
a) 24m/s b) 2+6t c) 14m/s d) 12m/s

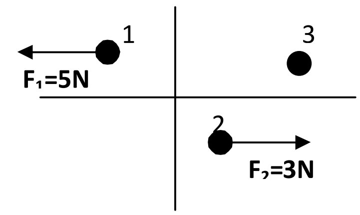
33. The direction of friction is always ________ to the direction in which the object is moving.
a) perpendicular b) opposite c) normal d) similar

34. When a 20 N force acts on an object then it moves 20 m in the same direction. The work is:
a) −40 J b) 40 J c) 400 J d) −400 J

35. Which of the following relation gives negative displacement
a) x_1= - 2m , x_2= 4m c) x_1= - 8m , x_2= - 1m
b) x_1= 6m , x_2= - 2m d) x_1= 7m , x_2= 9m

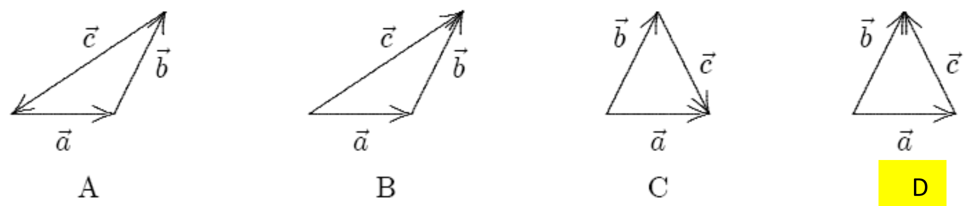
36. A ball is thrown with initial velocity of 15 m/s at an angle of 30^o from the positive x direction. The y-component of the initial velocity is :
a)30 m/s b) 7.5 m/s c)15 m/s d) 13m/s

37. In the figure, what is the magnitude of the force F_3 acting on particle 3 if the center of mass of the system is stationary?



a) 8 N   b) – 2 N   c) -8 N   d) 2 N

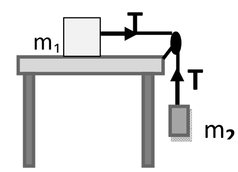
38. The vectors $\vec{a}, \vec{b}$, and $\vec{c}$ are related by $\vec{a}+\vec{c}=\vec{b}$. Which diagram below illustrates (يوضح) this relationship (العلاقة)?



39. If the components of the vector A are given by A_x= 8.6 cm and A_y=4.20 cm, then the direction of this vector with respect to the positive x-axis is:

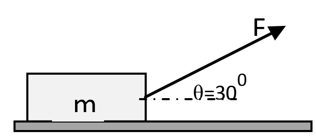
a) 32°   b) 60°   c)26°   d) 180°

40. In the figure shown; m_2 moves down with acceleration of 2 m/s^2 , the tension in the rope is 10 N. The value of m_2 is:



a)2.5 kg   b)1.28 kg   c) 8.0 kg   d) 50 kg

41. A block was pulled by a force 30 N, the block was going with a constant speed (as shown in the figure) on a rough (خشن) surface. The magnitude of the frictional force is:



a)26 N   b) 15 N   c) 98 N   d) 3 N

42. Each of four particles moves along an x axis. Their coordinates (in meters) as functions of time (in seconds) are given by:

particle 1: $x(t) = 3.5 - 2.7t^3$ particle 2: $x(t) = 3.5 + 2.7t^3$

particle 3: $x(t) = 3.5 + 2.7t^2$ particle 4: $x(t) = 3.5 - 3.4t - 2.7t^2$

Which of these particles have constant acceleration?

a) All four   b) Only 1 and 2   c) Only 2 and 3   d) Only 3 and 4

43. If A=10 and B=6, the angle between them is 60°, the magnitude of the vector product $\vec{A} \times \vec{B} =$

a) 20   b) 30   c) 51.96   d) 60

44. A particle moves through a **displacement** $\vec{d} = (15m)\hat{i} - (12m)\hat{j}$ along a straight line while being acted on by a **force** $\vec{F} = (210N)\hat{i} - (150N)\hat{j}$. **The work** done on the particle by this force is:

a) 4950 J   b) 1350 J   c) 3150 J   d) 1800 J

"حل امتحان النهائي لعام ١٤٣٣هـ - الترم الثاني"

King Abdulaziz University
Faculty of Sciences
Physics Department

Final Exam - Phys 110

Second Term
1432-1433 H

Date: 1 / 7 / 1433H

A

Name: ID No: Section:

CHOOSE THE CORRECT ANSWER

1. The law of conservation of linear momentum is $\left(\vec{P}_i = \vec{P}_f\right)$.

a) True **b)** False

2. 12 days = 700 hours

a) True **b)** False

3. The instantaneous power $P = \dfrac{W}{\Delta t}$

a) True **b)** False

4. The prefix for one thousand is kilo

a) True **b)** False

5. An object's displacement divided by the time interval is the definition of average speed

a) True **b)** False

6. The instantaneous acceleration $a = \dfrac{d^2 v}{dt^2}$

a) True **b)** False

7. If the body starts from rest, its initial velocity is taken as zero.

a) True **b)** False

8. A particle moved from x = -5 to x = 5, its displacement = zero. $\Delta X = X_2 - X_1 = 5-(-5) = 10$

a) True **b)** False

9. The angle between the gravitational force and the displacement of a falling body is 180°

a) True **b)** False

$F_g \downarrow \downarrow d \quad \theta = 0$

10. Kinetic friction force f_k opposes the motion on a frictionless surface

a) True **b)** False

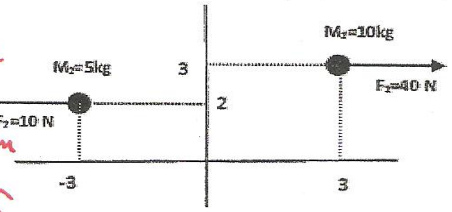
Use the following to answer questions 11-12:

In the figure, two objects are subjected to external forces

$x_{com} = \frac{m_1 x_1 + m_2 x_2}{m_1 + m_2} = \frac{(10)(3) + (5)(-3)}{15} = 1m$

$y_{com} = \frac{m_1 y_1 + m_2 y_2}{m_1 + m_2} = \frac{(10)(3) + (5)(2)}{15} = 2.7m$

$r_{com} = x_{com}\hat{i} + y_{com}\hat{j} = \hat{i} + 2.7\hat{j}$



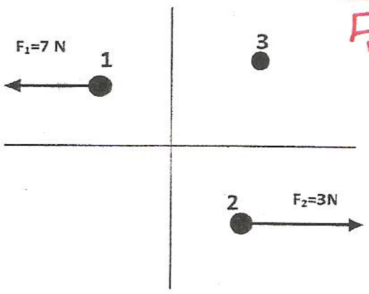
11. The position of the center of mass is:

a) $r_{com} = 7\hat{i} + 2\hat{j}$ **b)** $r_{com} = \hat{i} + 2.7\hat{j}$ **c)** $r_{com} = 5\hat{i} + \hat{j}$ **d)** $r_{com} = 2.7\hat{i} + 3\hat{j}$

12. The acceleration of the center of mass is: $F_{net} = M\vec{a}_{com} \Rightarrow F_1 + F_2 = M a_{com} \Rightarrow$

a) 1 m/s² **b)** 4 m/s² **c)** 3 m/s² **d)** 2 m/s² $a_{com} = \frac{F_1 + F_2}{M} = \frac{40 - 10}{15} = 2 m/s^2$

13. In the figure, three particles on which external forces act. If the center of mass of the three particle system is accelerating to the right, **what are the magnitude and direction of the force acting on the third particle?**



$\vec{F}_{net} = M\vec{a}_{com}$

$F_1 + F_2 + F_3 = M a_{com}$

$a_{com} \Rightarrow$ positive

$F_3 = Ma - F_1 - F_2 = Ma - (-7) - 3$
$= Ma + 4$

a) F_3 = 4 N , to the right **b)** F_3 > 4 N , to the right **c)** F_3 < 4 N , to the right **d)** F_3 = zero

Use the following to answer questions 14-15:

A system consists of four particle having masses and velocities as follows:

Particle	Mass	Velocity	K.E. $= \frac{1}{2}mv^2$	$P = mv$
1	8 kg	2 m/s	$\frac{1}{2}(8)(2)^2 = 16$	$P_1 = (8)(2) = 16$
2	2 kg	4 m/s	$\frac{1}{2}(2)(4)^2 = 16$	$P_2 = (2)(4) = 8$
3	4 kg	4 m/s	$\frac{1}{2}(4)(4)^2 = 32$	$P_3 = (4)(4) = 16$
4	8 kg	zero	$\frac{1}{2}(8)(0)^2 = 0$	$P_4 = (8)(0) = 0$

14. Which two particles has the same kinetic energy

a) particle 1 and 2 **b)** particle 2 and 3 **c)** particle 1 and 4 **d)** particle 3 and 4

15. The linear momentum of the four particle system is: $P = P_1 + P_2 + P_3 + P_4 = 16 + 8 + 16 + 0 = 40$ kg m/s

a) 40 kg m/s **b)** 16 kg m/s **c)** 8 kg m/s **d)** zero

16. A sliding box of mass m= 16 kg suddenly exploded into two pieces, one piece m_1= 10 kg move with velocity v_1=+2 m/s, the second piece m_2 move with v_2=+10 m/s, **what was the velocity of the mass m?**

$MV = m_1 V_1 + m_2 V_2$

$16V = 10 \times 2 + 6 \times 10 \Rightarrow V = \frac{80}{16} = 5$ m/s

a) 5 m/s **b)** 12 m/s **c)** 16 m/s **d)** 10 m/s

17. A body of mass 5 kg moving with velocity v_0=10 m/s and acceleration 2 m/s^2, **the kinetic energy of the body after 4 seconds is:**

$V_f = V_0 + at = 10 + (2)(4) = 18$ m/s

$K_f = \frac{1}{2} m v_f^2 = \frac{1}{2}(5)(18)^2 = 810$ J

a) 90 J **b)** 810 J **c)** 81 J **d)** 45 J

Use the following to answer questions 18-19:

A force F is applied to a body of mass **100 kg** moving initially with velocity **14 m/s** on a frictionless surface and accelerates it with an acceleration of **-2 m/s²** until it stopped. $V_f = 0$

$F = ma = (100)(-2) = -200$ N

$v^2 = v_0^2 + 2a(x - x_0) \Rightarrow (x - x_0) = \frac{v^2 - v_0^2}{2a} = \frac{0 - (14)^2}{2(-2)} = 49$ m

18. The work done by the force F is:

$W = Fx = (-200\text{ N})(49\text{ m}) = -9800$ J

a) -1900 J **b)** -6800 J **c)** -8000 J **d)** -9800 J

19. The magnitude of the force that stopped the body is equal to:

$|F| = m|a| = (100)(2) = 200$ N

a) 100 N **b)** 400 N **c)** 200 N **d)** 300 N

Use the following to answer questions 20-21:

A force $\vec{F} = 2\hat{i} - 7\hat{j}$ is applied to a block of mass **25 kg** that moves a distance $\vec{d} = -2.5\hat{i}$ over a frictionless surface.

20. The work done on the block by the force F is:

$W = \vec{F} \cdot \vec{d} = (2\hat{i} - 7\hat{j}) \cdot (-2.5\hat{i}) = -5$ J

a) -5 J **b)** 7 J **c)** 10 J **d)** -12 J

21. If the final kinetic energy of the block is 200 J, its final speed is :

a) 2 m/s **b)** 6 m/s **c)** 8 m/s **d)** 4 m/s

22. A block is pulled at a constant speed of 12 m/s across a horizontal floor by a force of 66 N directed 60^0 above the horizontal. **What is the power acting on the block due to this force?**

a) 396 Watt **b)** 349 Watt **c)** 379 Watt **d)** 369 Watt

23. Kilowatt-hour is the unit of:

a) work **b)** spring constant **c)** momentum **d)** power

24. What is the gravitational force on a man of mass 60 kg when he is sitting in a car that accelerates at 2 m/s^2 ?

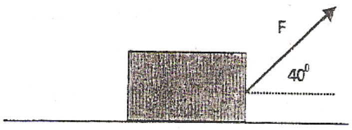
a) $\vec{F}_g = -5.88\hat{j}$ **b)** $\vec{F}_g = -58.8\hat{j}$ **c)** $\vec{F}_g = -5880\hat{j}$ **d)** $\vec{F}_g = -588\hat{j}$

25. A spring has a force constant of 300 N/m. **The work done on the spring to stretch it by 5 cm from its relaxed position is:**

a) -0.27 J **b)** -0.67 J **c)** -0.38 J **d)** -0.1 J

Use the following to answer questions 26-27:

A man is sliding a box of mass **70 kg** over a frictionless floor a distance **d = 3 m** by a force **F = 10 N** as shown in the figure.



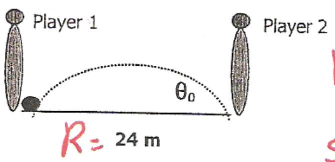
26. The work done by the force F is:

a) 23 J **b)** 24 J **c)** 31.2 J **d)** 0

27. The work done by normal force F_N is:

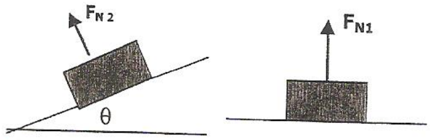
a) 23 J **b)** 38 J **c)** 31..2 J **d)** zero

28. In the figure, player 2 kicked a ball towards player 1 with velocity 18 m/s. If the ball hit player 1, the angle θ_0 must be:



a) 90^0 **b)** 23.3^0 **c)** 36.2^0 **d)** 54^0

29. From the two figures:



$F_{N_1} = mg$

$F_{N_2} = mg \cos \theta$

$\therefore F_{N_1} > F_{N_2}$

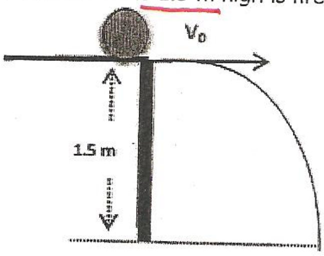
a) $F_{N1} < F_{N2}$ **b)** $F_{N1} = F_{N2}$ = zero **c)** $F_{N1} = F_{N2}$ **d)** $F_{N1} > F_{N2}$

30. From the figure, if the static frictional force $\vec{f}_s$ and the force $\vec{F}$ balance each other, then:

a) The body moves with constant velocity
b) The body moves to the right
c) The body moves to the left
d) The body is at rest

Use the following to answer questions 31-32:

A ball on the top of a table that is 1.5 m high is fired horizontally as shown in the figure.



$\because V_{0y} = 0,\ y = 0,\ y_0 = +1.5$

$y - y_0 = V_{0y} t - \frac{1}{2} g t^2$

$-1.5 = -\frac{1}{2}(9.8)t^2$

31. The time that the ball take to reach the ground is: $\therefore t = \sqrt{\frac{(2)(1.5)}{9.8}} = 0.55\,s$

a) 0.22 s **b)** 0.33 s **c)** 0.44 s **d)** 0.55 s

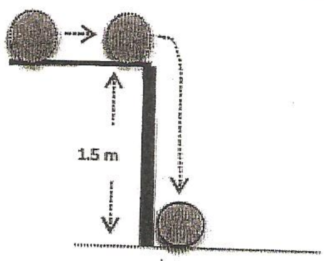
32. If the ball is fired with a speed of 5 m/s, the horizontal component of the ball's velocity v_x is:

a) 5 m/s **b)** 2.5 m/s **c)** 5.5 m/s **d)** 2 m/s

$V_{0x} = 5\ m/s,\ a_x = 0$

$V_x = V_{0x} = 5\ m/s$

33. A ball rolls on the table and falls vertically to the ground as shown, the magnitude of the acceleration of the ball during the fall equals:



a) 9.8 m/s^2 **b)** zero **c)** 4.9 m/s^2 **d)** 980 m/s^2

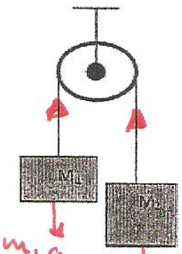
34. The figure shows two blocks m_1 = 1.3 kg and m_2= 2.8 kg connected by a cord that passes over a frictionless pulley, if the tension in the cord is T = 17 N, and the mass m_2 is moving downward, **the magnitude of the acceleration of m_2 is:**

$F_{net} = ma$

$T - m_2 g = -m_2 a$

$a = \frac{T - m_2 g}{-m_2} = \frac{17 - (2.8)(9.8)}{-2.8}$

$a = 3.73\ m/s^2$

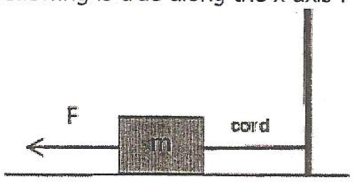


a) 3.7 m/s² **b)** 10.5 m/s² **c)** 7.3 m/s² **d)** 11.4 m/s²

35. In the figure a block of mass m on a frictionless surface is attached to the wall by a cord and a force F is applied as shown, (**the block does not move**). Which of the following is true along the x axis ?

$\vec{F}_{net} = m\vec{a}$

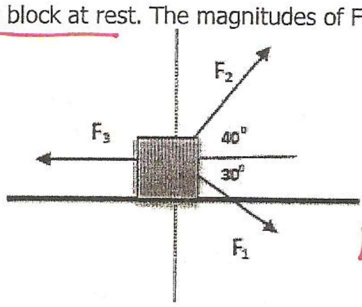
$T - F = 0$



a) $F + T = 0$ **b)** $T - F = 0$ **c)** $T - F = ma$ **d)** $T + f_s - F = 0$

Use the following to answer questions 36-37:

In the figure, three forces act on a block at rest. The magnitudes of F_1 and F_2 are 10 N, and 20 N respectively.



$a = 0$

$F_{net} = 0$

$F_1 + F_2 + F_3 = 0$

$F_3 = F_1 \cos 30° + F_2 \cos 40°$

$= 10 \cos 30° + 20 \cos 40°$

$= 8.66 + 15.32 = 23.98\ N \approx 24\ N$

36. What is the magnitude of the third force F_3 along the x axis?

a) 20 N **b)** 24 N **c)** 30 N **d)** 34 N

37. The normal force $\vec{F}_N$ on the block is:

a) $F_N = F_g + F_1 \sin 30 - F_2 \sin 40$

b) $F_N = F_g - F_1 \sin 30 - F_2 \sin 40$

c) $F_N = ma_y - F_g - F_1 \sin 30 - F_2 \sin 40$

d) $F_N = -ma_y - F_g - F_1 \sin 30 - F_2 \sin 40$

38. A ball thrown vertically upward from ground level and reached a maximum height of 50 m, the speed with which the ball was thrown equals:

a) 40.5 m/s **b)** 31.3 m/s **c)** 22.7 m/s **d)** 15.4 m/s

$v^2 = v_0^2 - 2g(y - y_0)$

at max height $v = 0$

$0 = v_0^2 - (2)(9.8)(50)$

$v_0 = \sqrt{(2)(9.8)(50)}$

$= 31.3\ m/s$

Use the following to answer questions 39-40:

A particle of mass m attached by a string and moves in a circle of radius r= 0.2 m with constant speed of 6.4 m/s.

39. If the pull on the particle from the string is 205 N, the particles mass m is:

a) 7 kg **b)** 3 kg **c)** 5 kg **d)** 1 kg

$\therefore a = \frac{v^2}{r} = \frac{(6.4)^2}{0.2} = 204.8\ m/s^2$

$m = \frac{F}{a} = \frac{205}{204.8} = 1\ Kg$

40. The distance that the particle travelled when completing two periods is:

a) $2\pi r$ **b)** $6\pi r$ **c)** $4\pi r$ **d)** $8\pi r$

distance $= 2 \times 2\pi r = 4\pi r$

41. The position vector of a particle is given by $x = -4t^2 - 2$, **its velocity at t = 5 s is:**

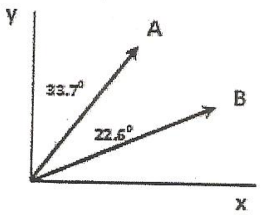
a) - 38 m/s **b)** - 40 m/s **c)** - 42 m/s **d)** - 44 m/s

$v(t) = \frac{dx}{dt} = -8t\ m/s$

$v(5) = (-8)(5) = -40\ m/s$

Use the following to answer questions 42-44:

In the figure two vectors $\vec{A} = 2\hat{i} + 3\hat{j}$ and $\vec{B} = 3\hat{i} + 2\hat{j}$



42. The product of $\vec{A} \cdot \vec{B}$ is equal to:

$\vec{A} \cdot \vec{B} = 6 + 6 = 12$ units

a) 10 units **b)** 8 units **c)** 11 units **d)** 12 units

43. The third vector that result from the cross product of $\vec{B} \times \vec{A}$ is:

a) in the + x direction
b) in the + y direction
c) perpendicular to $\vec{B}$ and $\vec{A}$
d) parallel to $\vec{B}$ and $\vec{A}$

44. The angle between $\vec{B}$ and the x-axis is:

a) 33.7° **b)** 35.5° **c)** 10.5° **d)** 15.6°

$90° - (33.7° + 22.6°) = 33.7°$